

Project title : Instrumentation and Process Automation

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Period covered : August 1980

NINO - Nitrate Monitoring

In connection with an internal request by Mr. D. Schulthess and Mr. J. Berney about nitrate and sugar monitoring in the pilot plant, a suitable and simple computerized device was defined in order to provide a better control of the fermentation and the sugar consumption in the process.

According to previous experiments conducted in that field, NO_3^- measurements based on specific electrodes have given correct information only for punctual determination followed by a storage of the sensors in a buffer solution. Furthermore, a rate of 5 to 10 minutes for sampling appears to be sufficient in the process to track the NO_3^- value and adjust the sugar concentration in the fermentor.

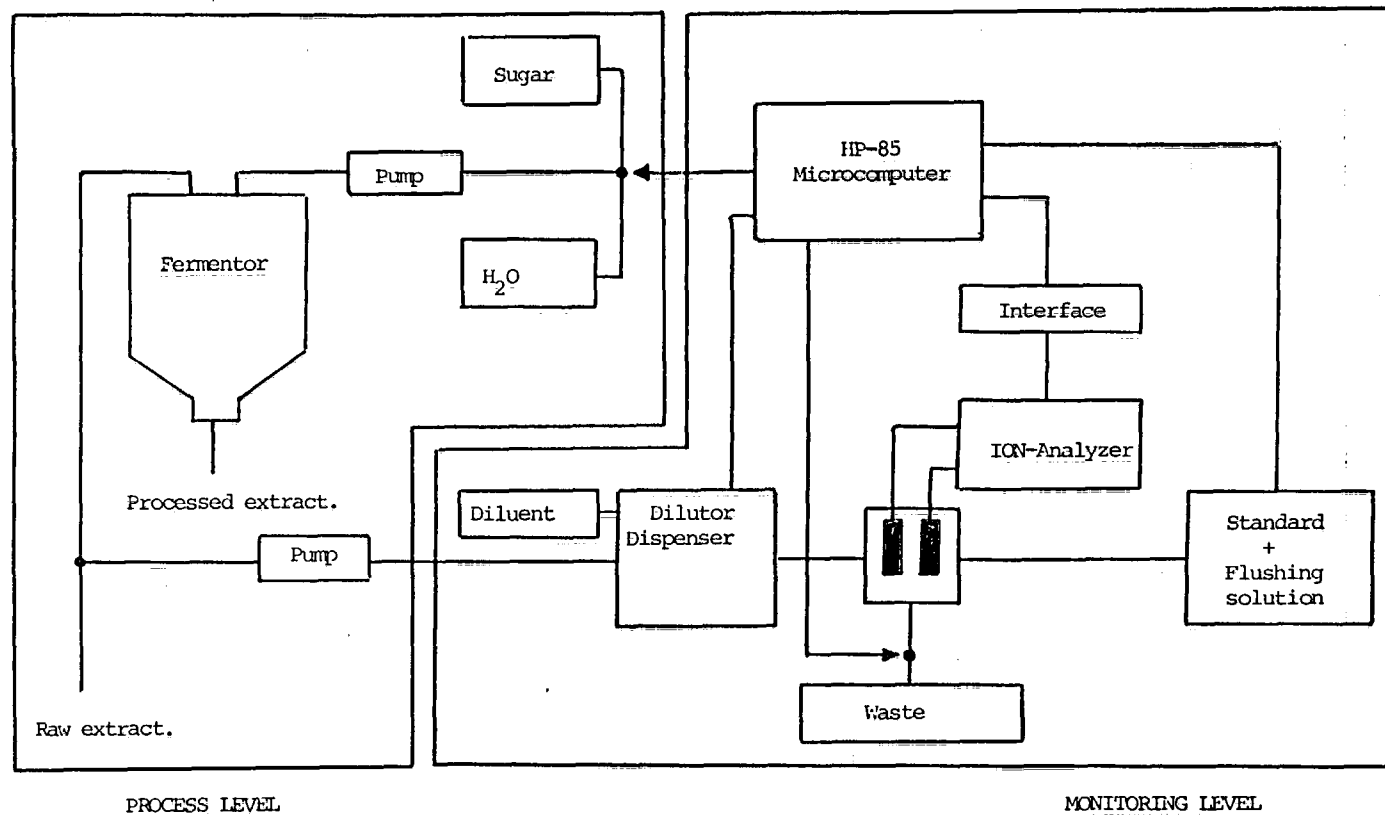
On that base, a set of NO_3^- electrodes are located in a specially designed vessel which can be alternatively fed by a "calibrated and diluted" sample of raw extract or a suitable "flushing and calibrating" reagent.

The data on the sample or standard are computed by an Orion ION-Analyzer (Model 901) and processed by a HP-85 microcomputer system. The latter with parallel read-write interfaces controls the whole monitoring according to the simplified annexed block diagram.

The following steps describe the main functions under computer control during monitoring.

1. Aspiration and dispensing of the diluted sample of raw extract with presetable dilution ratio.
2. NO_3^- reading and comparison with a predefined set point.
3. Alarm for off-range NO_3^- values.
4. Magnetic valves allowing sugar concentration adjustment actuated with a computerized opening time.
5. Distribution of flushing and standard reagent for electrodes protection.
6. Partial recalibration of ion-analyzer for drift correction.

These six basic steps are continuously repeated during the monitoring with a rate defined by the operator. Statistics on recorded data and graphical output representing NO_3^- concentration during the monitoring can be performed by the HP-85.



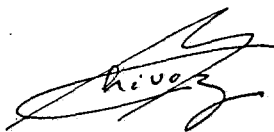
NO_3^- Monitoring - Block Diagram

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The hardware for this monitoring was ordered at the end of August and will be assembled during autumn 1980, depending on the ability of suppliers to provide the requested interfaces.

The test of this "step-monitoring" will be simulated in a first phase on a small scale laboratory fermentor without feedback and on a fixed NO_3^- concentration extract. These experiments will give a better understanding of electrode response for the discontinuous sampling-mode. Different kinds of feedbacks to glucose distribution will be attempted in a second phase before the transfer of the monitoring installation to the pilot plant.

The programs of the HP-85 are written in BASIC and the application software is easy to modify. Programs and experimental data can be stored on a magnetic tape cartridge of 210 kBytes.



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